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Typical fault current characteristics at a substation LV side

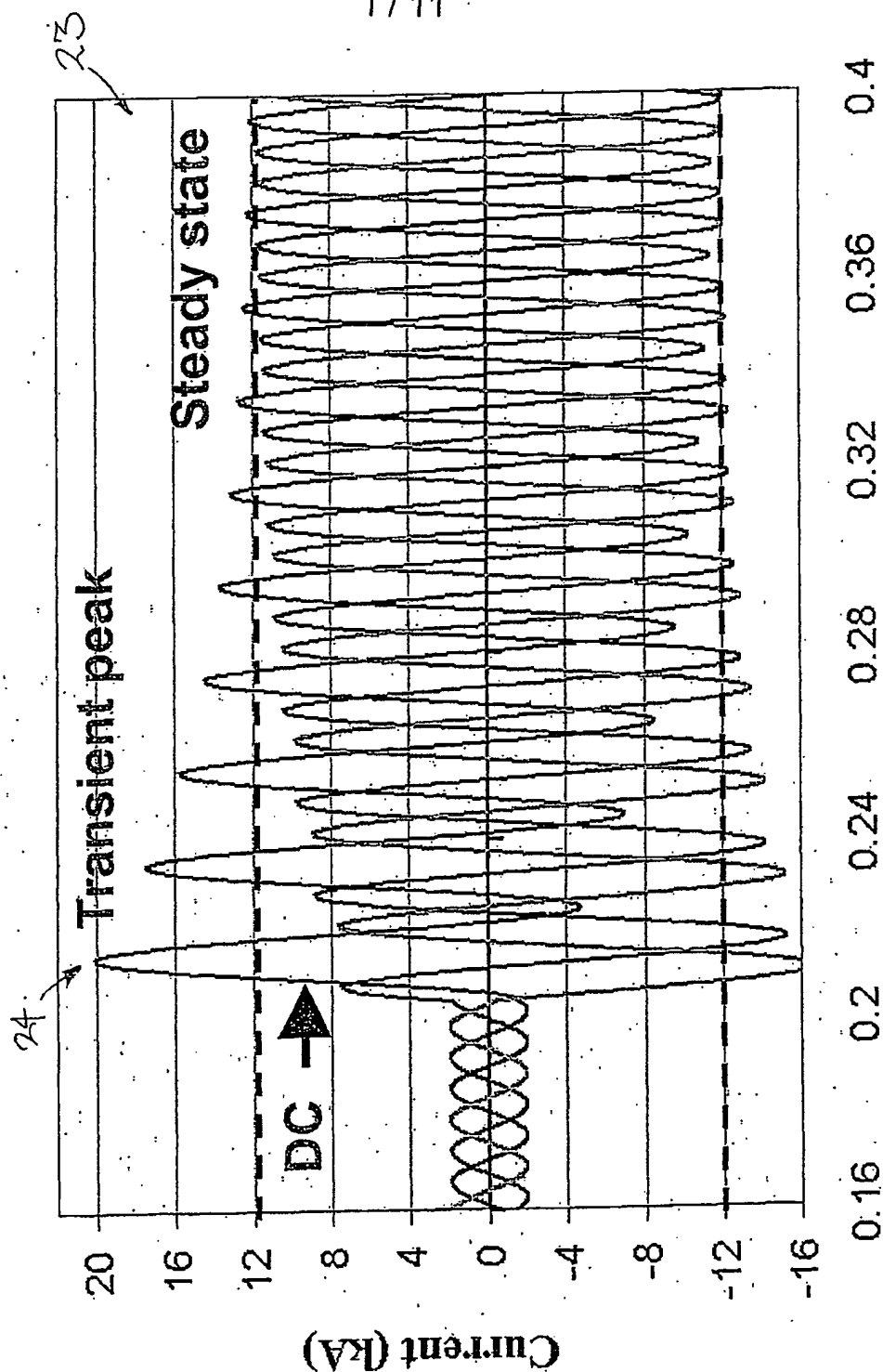


Fig. 1

Transient fault current per transformer SC-FCL Design option 2

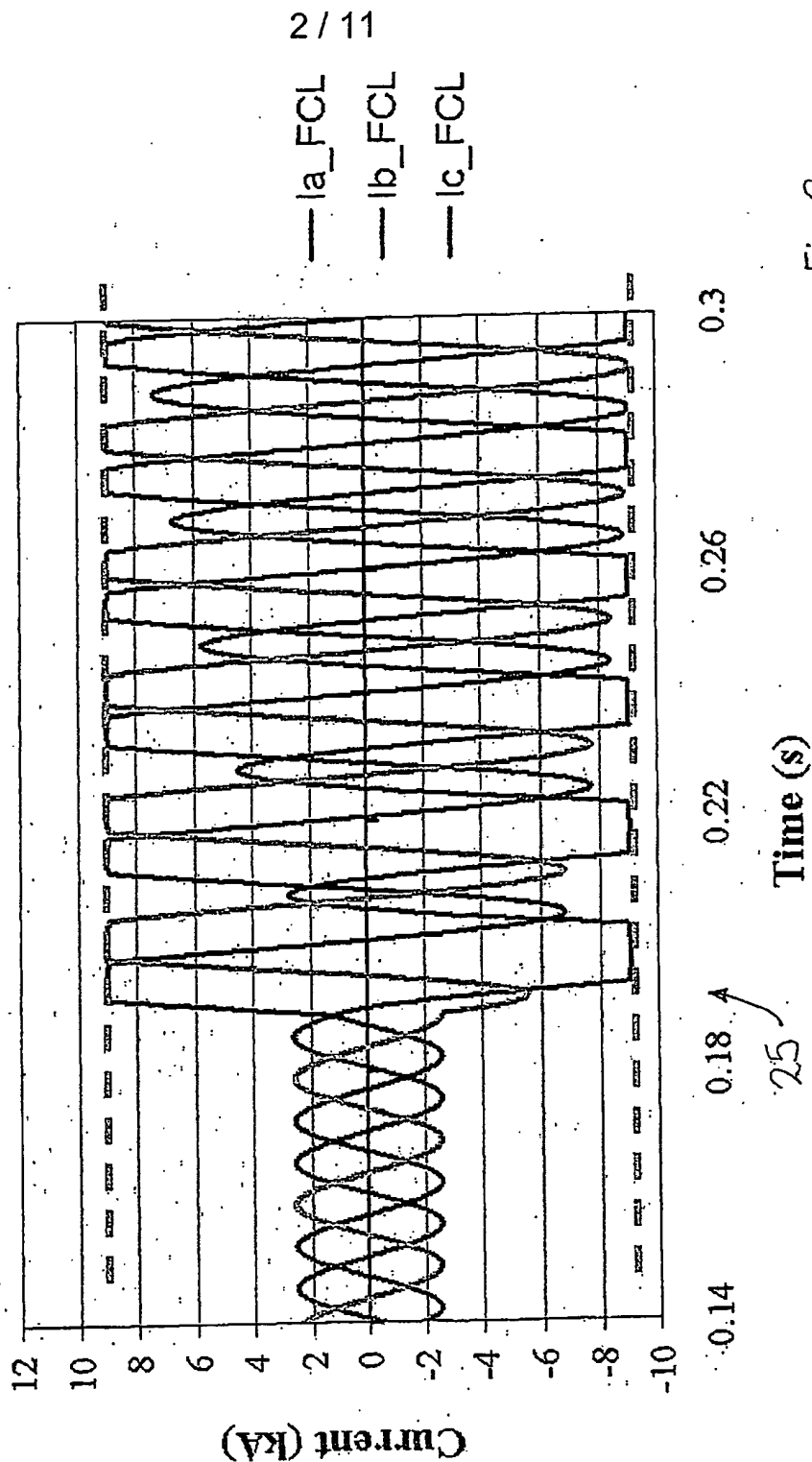


Fig. 2

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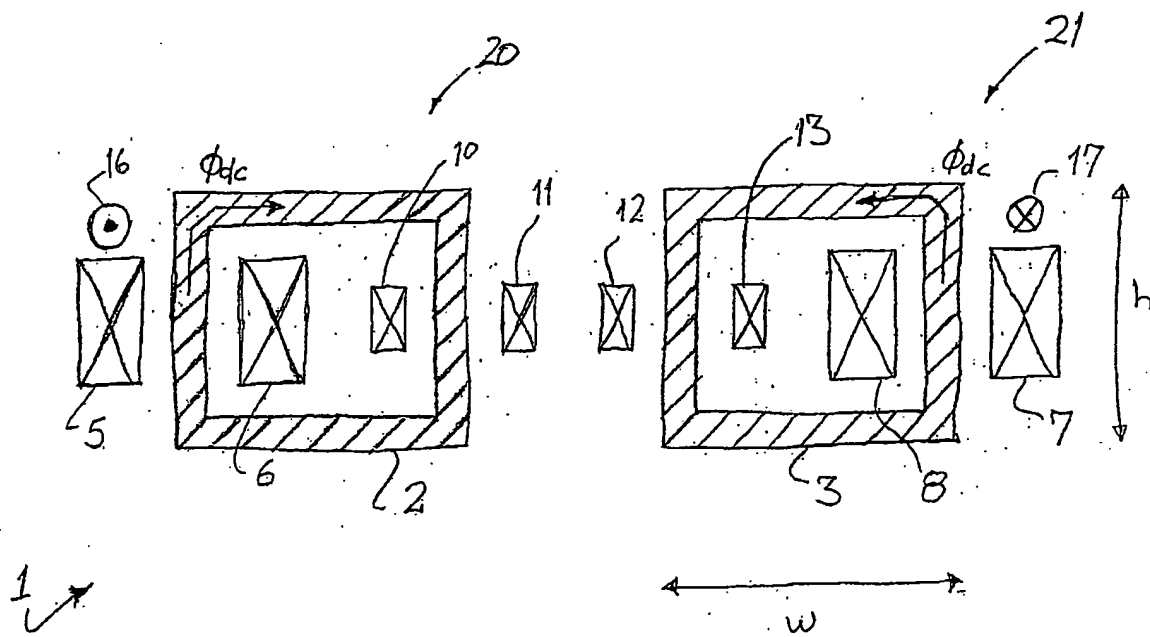


Fig. 3

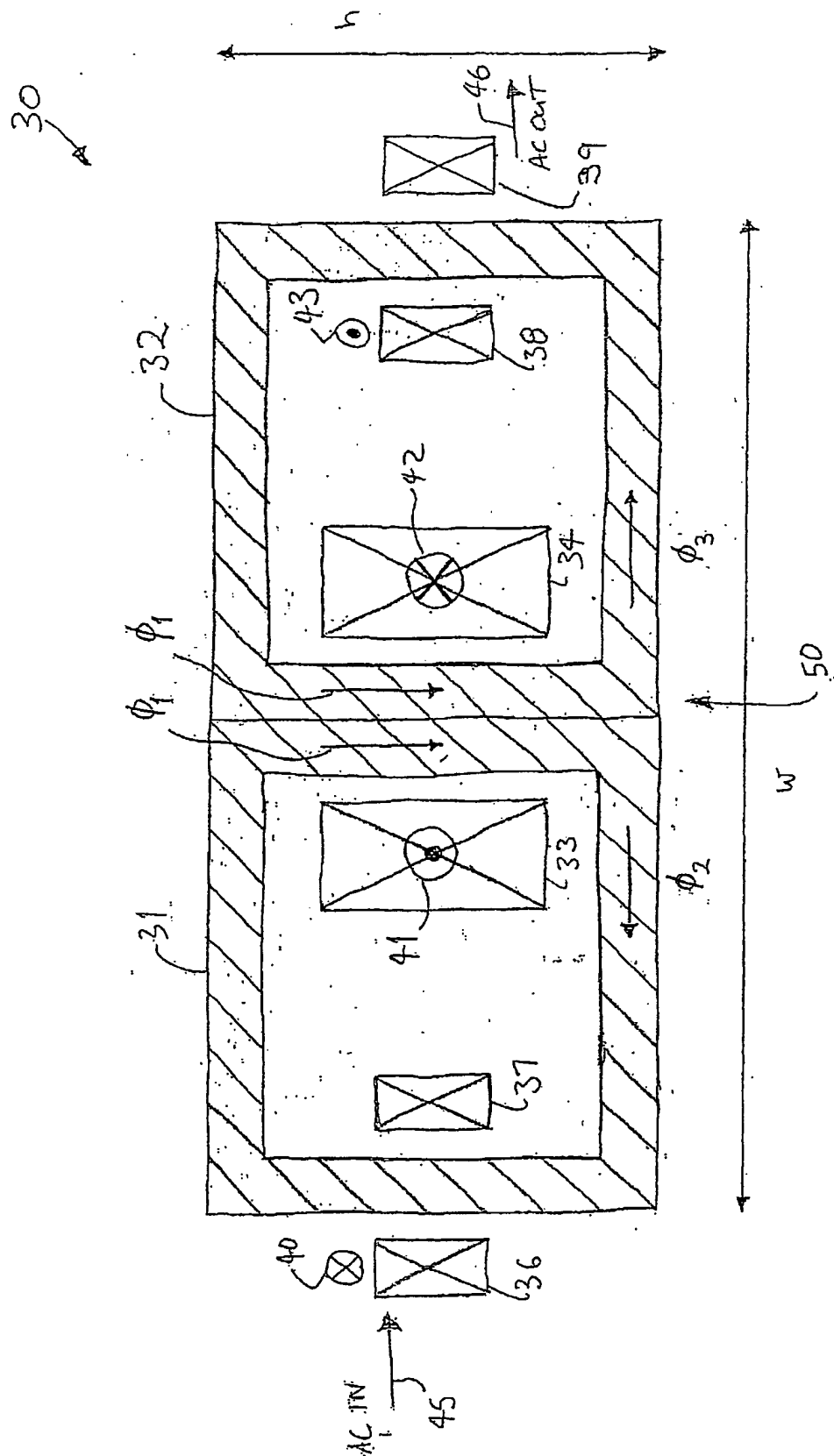
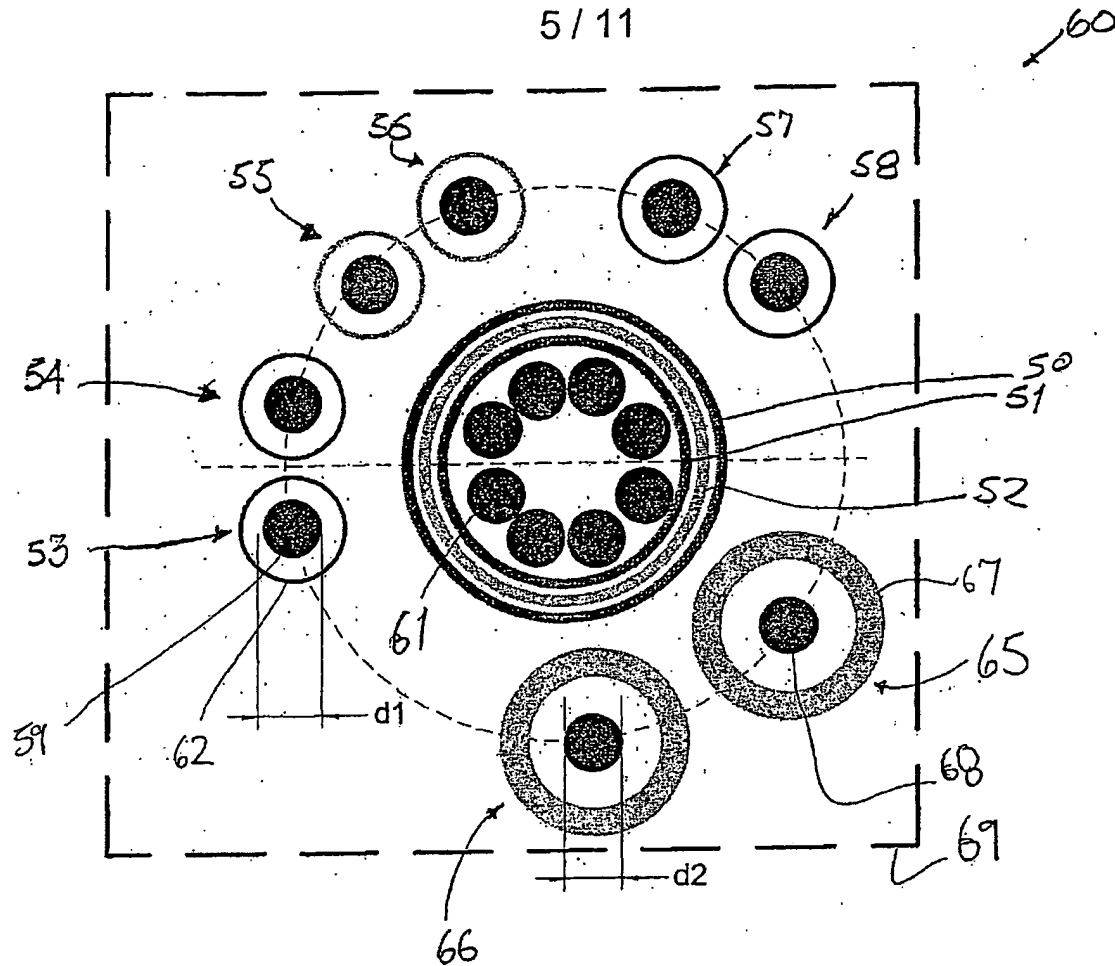


Fig. 4









-  Neutral earthing coils, for limiting earth fault currents by a greater than three phase symmetrical fault currents.
-  Three sets of AC coils for limiting symmetrical three phase faults - ident
-  Cryostat
-  HTS coil and support
-  Footprint
-  Iron core leg, diameter: d, window: w x h

Fig. 5

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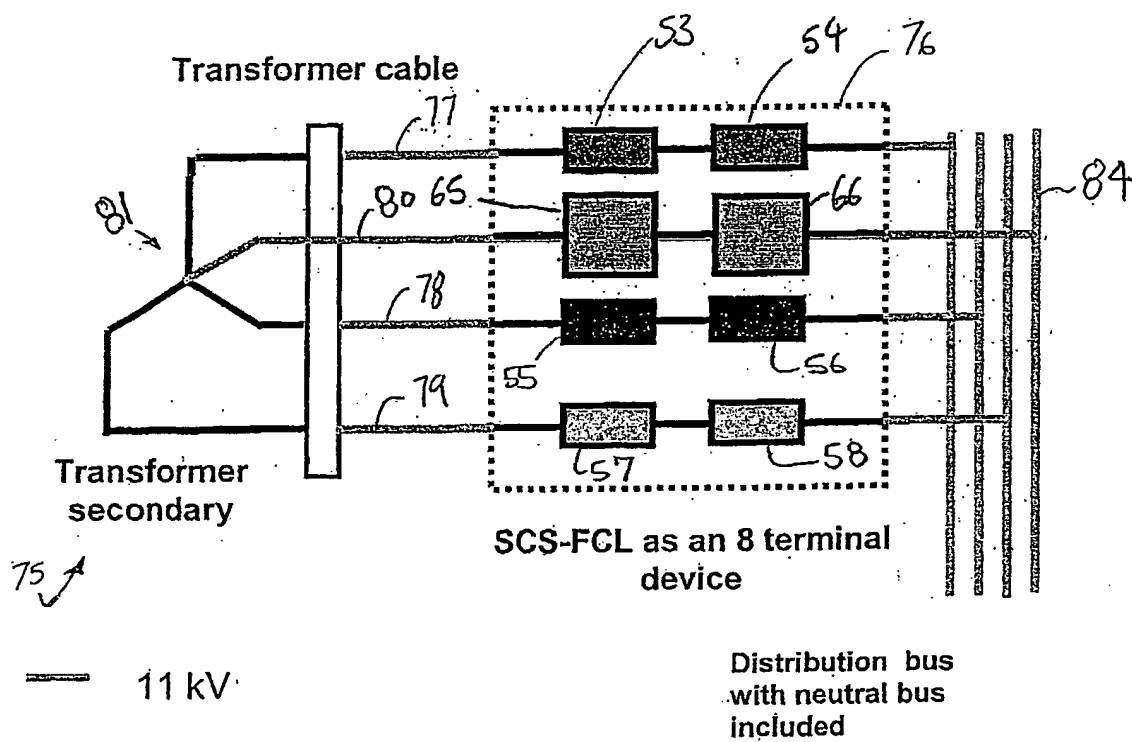
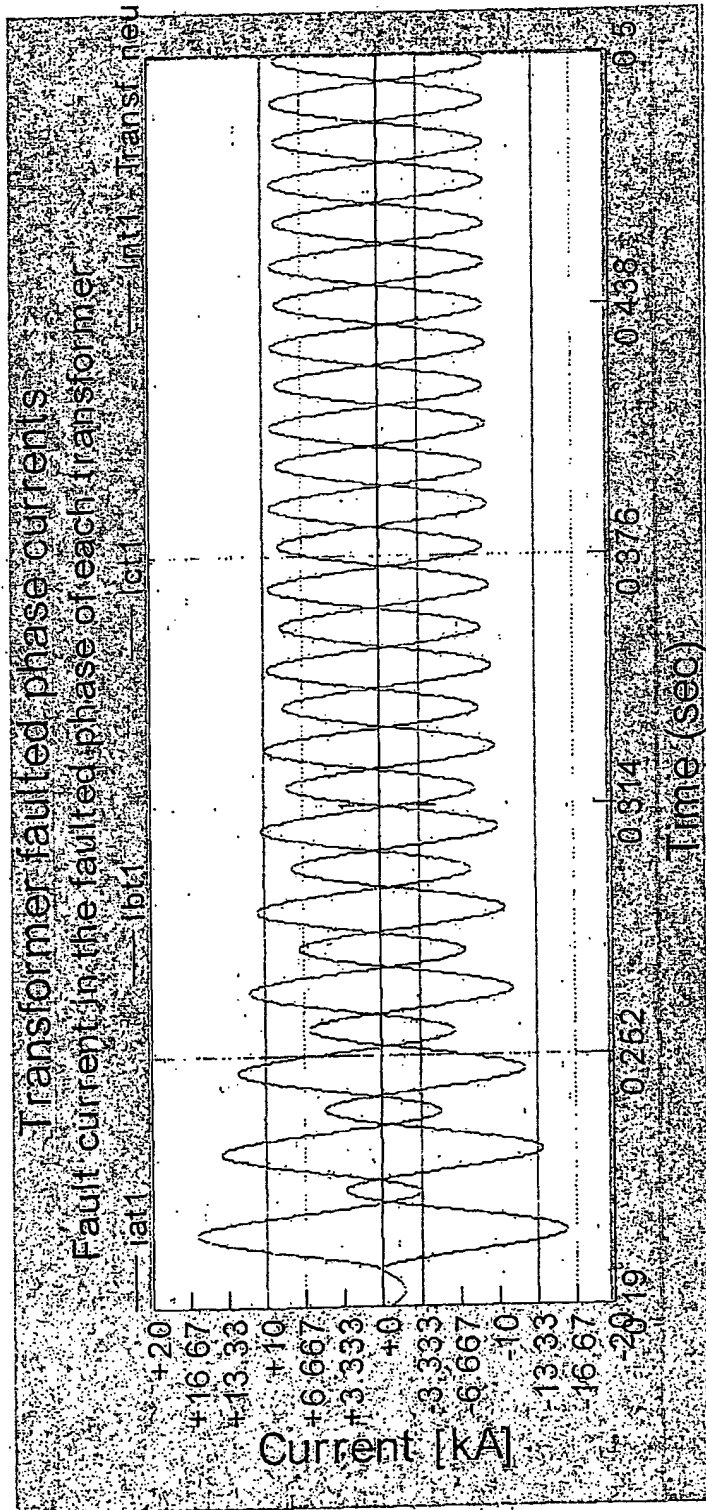


Fig. 6

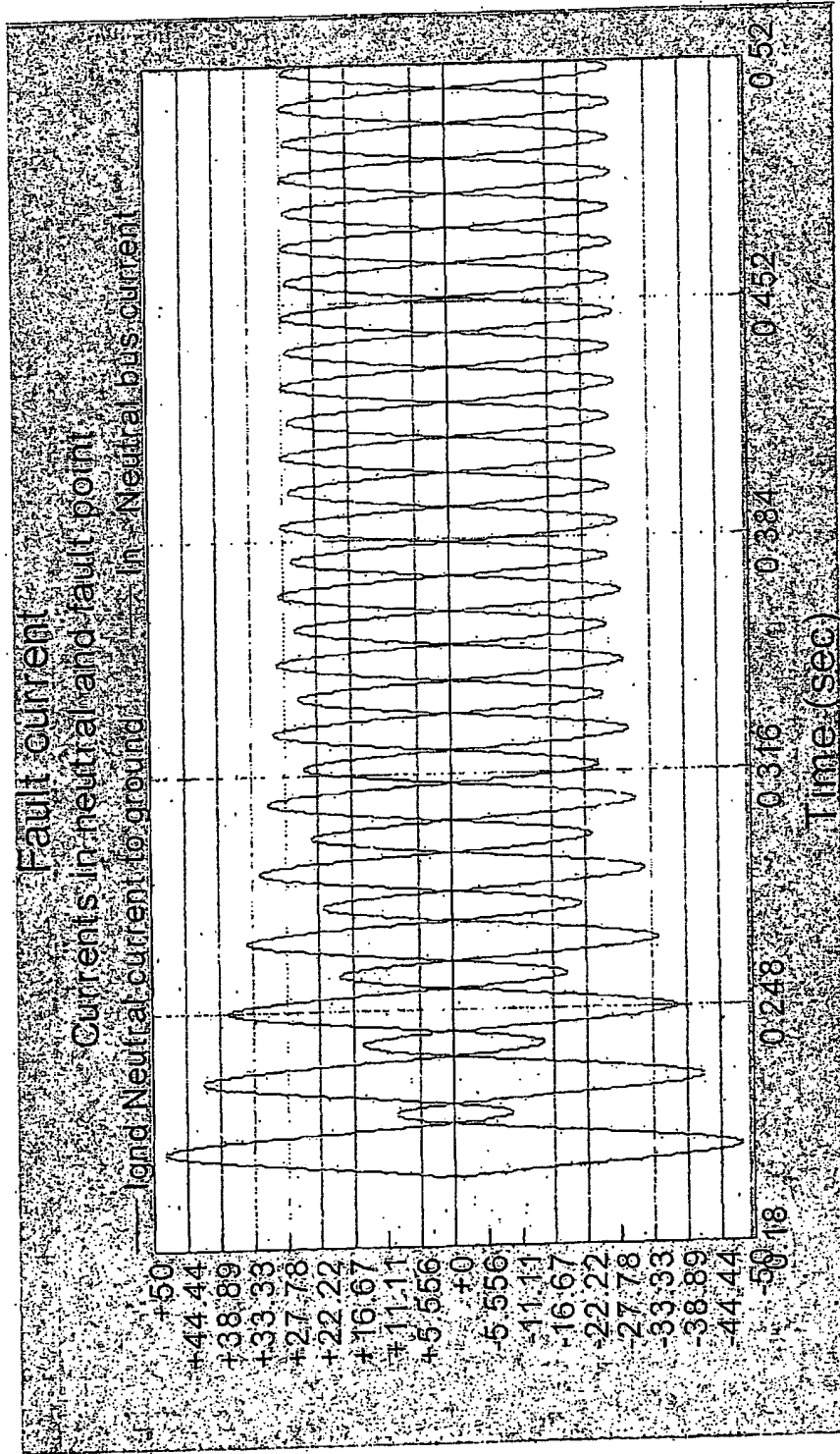
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Phase 'a' fault current in each of the three transformer line and neutrals for a phase 'a' to ground fault on the 11 kV bus without NER installed. The phase current amplitude is 9.19 kA (6.50 kA rms). And is equivalent to the neutral current amplitude.

Fig. 7

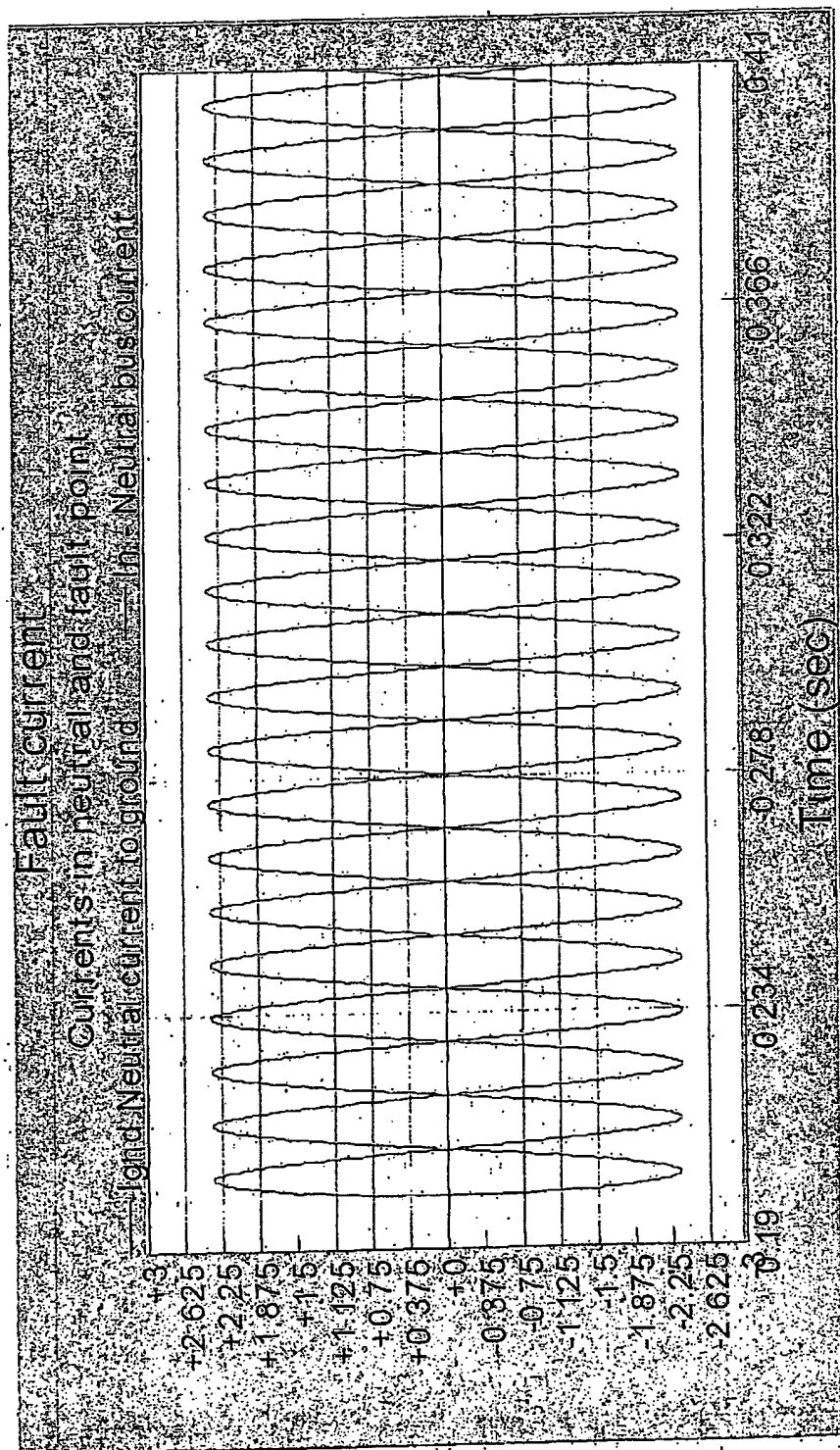
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Fault current at the 11 kV bus for a single line to ground fault on the 11 kV bus in the three transformer case without an NER.
Steady state peak amplitude = 27.72 kA (19.6 kA rms)

Fig. 8

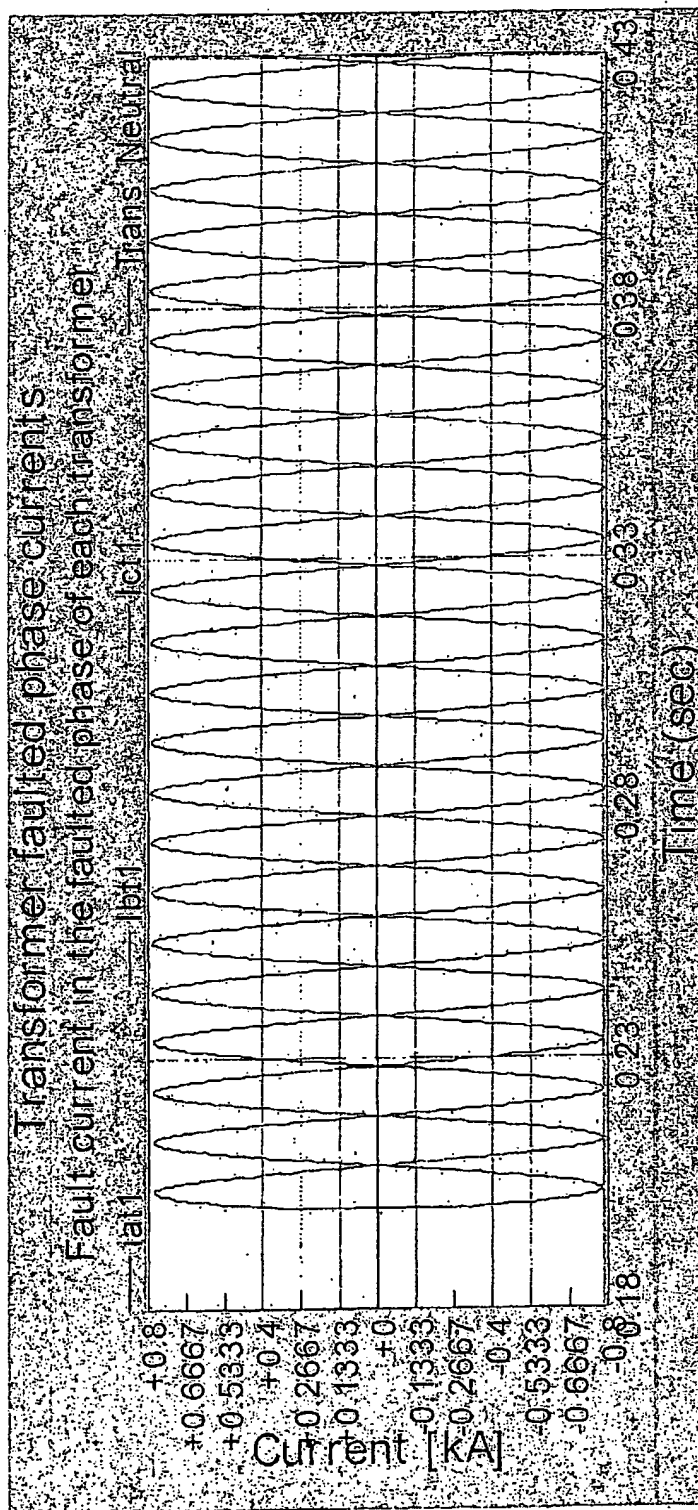
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Line to ground fault current on the 11 kV bus in the three transformer case with a 3.9Ω NER installed.
Steady state amplitude = 2.36 kA (1.67 kA rms). Refer Figure 16.

Fig. 9

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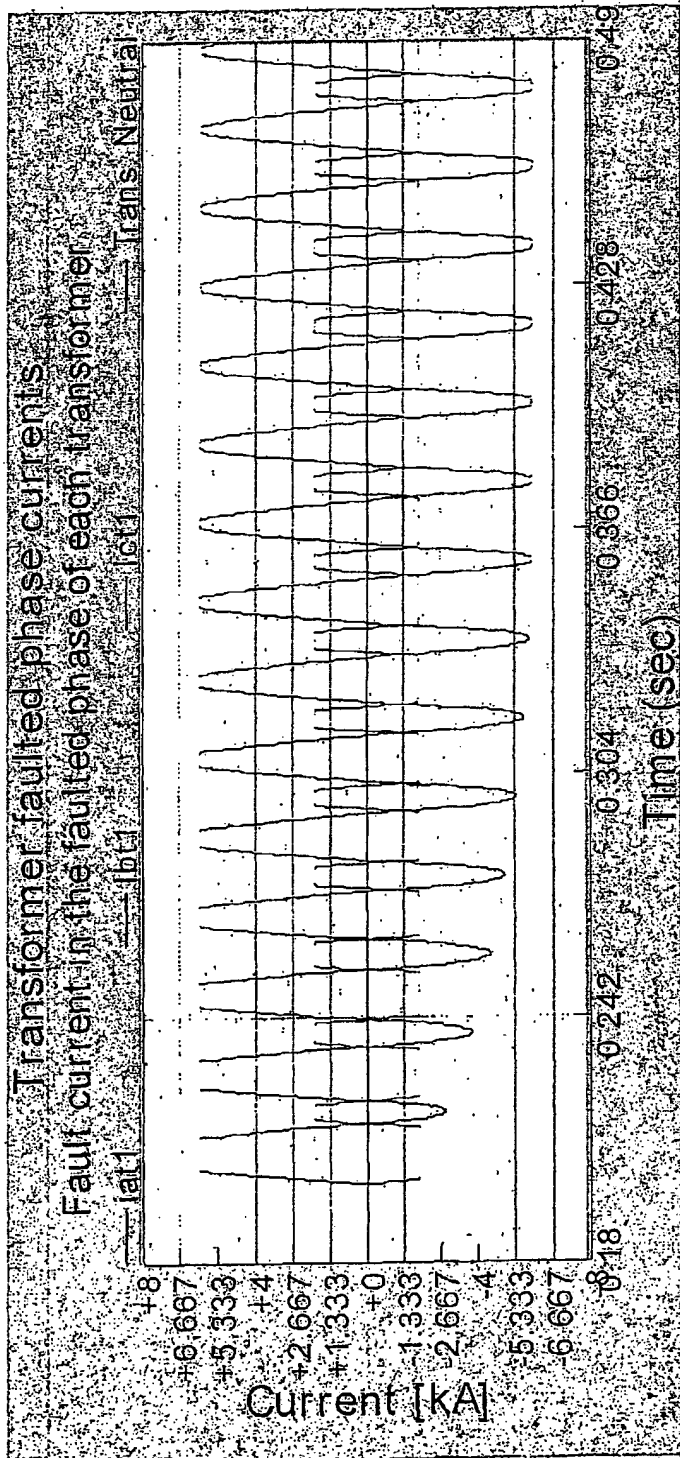


Phase 'a' fault current in each of the three transformers for a phase 'a' to ground fault on the 11 kV bus with a 3.9Ω NER installed. The steady state phase current and neutral current amplitude is 0.79 kA (0.56 kA rms).

Note: All three individual current waveforms in the faulted phase from the three transformers overlap in this diagram.

Fig. 10

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Effect of an 8 terminal SC-FCL on the earth fault current and the line fault current. The earth fault current is limited by a much greater amount compared to the phase currents as required by utilities. This design therefore allows the three phase line current to be limited by an amount which will meet the fault level requirements of the site, and the earth current to be limited by other criteria. The blue line shows how the line current is limited by the FCL and the black line shows how the earth current is limited by the FCL by a much greater amount. Note, because this is a line to ground fault, the other 2 phase currents are not effected and are small and do not show up on this graph. The fault current is limited to 1.4 kA peak or 1 kA RMS per transformer (i.e 3 kA for the whole substation) , as required.

Fig. 11